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ABSTRACT

A study investigated the effectiveness of peer critiquing and the use of writing models in the preparation of scientific reports. Primary trait scoring was used to evaluate laboratory reports on exercise physiology written by four different groups of sophomore biology majors: (1) a reference (control) group that prepared for writing reports with only an outline and no additional guidance, (2) a treatment group composed of students prepared with techniques of peer critiquing and writing model analysis, (3) a second treatment group composed of students introduced only to model analysis, and (4) a third treatment group composed of students introduced only to peer critiquing. Students in all four groups received identical instructions for the preparation of the report and participated in an identical lab session. The results of the lab report evaluations indicated that all three treatment groups scored higher on the primary trait assessment of the reports than did the reference group. The Duncan multiple-range test indicated that the three treatments increased the quality of the lab reports significantly. It also indicated that the group that employed modeling alone wrote better reports than did the other groups. The study suggests that writing model analysis and peer review and revision will increase the quality of writing in student laboratory reports, and that modeling is an especially useful technique in content classrooms and in those classes with high enrollments. (HTH)

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Effects of Peer Critiquing and Model Analysis on the Quality
of Biology Student Laboratory Reports

Although the practice of peer critiquing of student papers as a way of improving student writing is a well-established method and has been endorsed by numerous composition specialists including James Moffett, Peter Elbow, Thom Hawkins, and Ken Bruffee, very little research has been done to substantiate the value of the approach. In an investigation of the usefulness of a "collaborative composing method," which involved free writing, small group response, and revision, John Clifford found that the method has merit in the composition classroom. Clifford's research is not designed to test the effectiveness of peer critiquing per se, however. Moreover, virtually no research has been done to measure the effectiveness of group inquiry in the content classroom. Our research was designed to investigate the usefulness of peer critiquing and revision in the preparation of biology laboratory reports. It was also designed to test the effectiveness of the use of models of scientific writing in the preparation of the reports.

Background

The project was an outgrowth of the Humanities Department's Writing Across the Curriculum Program sponsored by a grant from the General Motors Foundation which is now in its fifth year. Members of the department have conducted a number of four-day in-service workshops for faculty in a variety of disciplines including business, geology, social science, engineering, and

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biological sciences. Workshops introduce faculty to the fundamentals of recent composition research and theory which suggests that: 1) writing is a mode of discovery as well as a mode of communication; and 2) the composing process is complex and recursive but essentially involves the movement from "expressive" or "writer-based" writing, i.e., writing written for the self which is freed of the constraints of an audience and hence conducive to discovery, toward "transactional" or "reader-based" writing, i.e., writing which communicates with an audience. One of the activities of a four-day workshop involves faculty in the composing process by asking them to draft and then revise a narrative essay describing a memorable writing experience. Revision is based on feedback received in peer critique sessions.

Many of the participants return from the workshops with a variety of new pedagogical techniques they are anxious to try out in their classes: journals, peer critique sessions, multiple drafts, and writing assignments which are geared toward specific audiences.

Professor Gratz, our collaborator on this project, was one such faculty member. He was aware that the quality of the writing in the biology lab reports he was receiving was poor; they were often rambling, disorganized discussions of unassimilated information. He was therefore highly motivated to change his approach. In the fall of 1980 he structured the three-quarter sequence in biology which he and a colleague taught to include both peer critiquing and model analysis. Enrollment in the course was approximately 60-70; students attended a lecture together but were divided into five different lab sections. Both the peer critiquing and the modeling took place during lab sessions. The first two quarters, in both embryology and anatomy, students were introduced to the genre of scientific writing through model analysis of articles published in journals in the field. Initially, Gratz

provided a detailed analysis of an article from a scientific journal. The article was a well-organized discussion of a topic designed to be of interest to students—turtle urine. Students were subsequently asked to prepare written critiques of articles they themselves selected and to discuss these in small groups. In their physiology course third quarter, students prepared their own lab reports, received feedback on them in small groups, and revised them before submitting them for a grade.

Both Professor Gratz and his colleague, Martha Janners, felt strongly that the techniques were successful in producing lab reports which were better organized and more coherent than ones they had previously received. We decided to attempt to measure the gains students seemed to be making and so began to devise a research design which would allow us to work within already existing administrative and pedagogical structures. The result was a design which was far from ideal but which was at least satisfactory given that we had minimal control over course assignments or student populations.

Method

We used primary trait scoring to evaluate laboratory reports on exercise physiology written by four different groups of students, all of whom were sophomore biology majors: 1) A reference group was composed of students enrolled in a two-quarter sequence in biology taught in 1980-81 by a professor who had never attended a Writing Across the Curriculum Workshop and who prepared his students for their reports in the traditional way—by providing them an outline but no additional guidance; 2) A treatment group was composed of students enrolled in the three-quarter sequence in biology taught by both Gratz and Janners in 1980-81. Students were prepared as described above, through use of the techniques of peer critiquing and model analysis; 3) A

second treatment group was composed of students enrolled in the three-quarter sequence taught by Gratz and Janners in 1981-82. These students were introduced only to modeling; 4) A third treatment group was composed of students enrolled in a two-quarter sequence in biology taught by Gratz. They were introduced only to peer critiquing. In all three treatment groups Gratz introduced students to the approaches used although individual lab sections were taught by teaching assistants. Students in all four groups received identical instructions for the preparation of the report and participated in an identical lab session.

Reports written by sophomore-level biology majors were scored by two teaching assistants from the Department of Biological Sciences who received training in primary trait scoring. Data was then analyzed using two statistical techniques, analysis of variance and the Duncan Multiple-Range Test.

Results

All three treatment groups scored higher on the primary trait assessment of the reports than did the reference group. An analysis of variance indicated that there was a significant difference in mean scores but did not reveal where the differences lay. The Duncan multiple-range test indicated that the three treatments increased the quality of the lab reports significantly. It indicated, as well, that the group which employed modeling alone wrote better reports than the other groups.

Subjective impressions resulting from Gratz' reading of the reports were that lab reports were better organized in the treatment groups. Students in these groups tended to provide better discussions of the data gathered during the lab session. There were few rambling discussions or unassimilated

passages from textbooks.

Discussion

The study suggests that model analysis and peer review and revision will increase the quality of writing in student laboratory reports. It suggests, as well, that modeling is an especially useful technique. Furthermore, the study demonstrates that techniques such as those examined can be used effectively in the content classroom, even in those classes which have large enrollments.

Student reaction confirmed the experimental results. Students mentioned in course evaluations that they found all the approaches to be useful but that they especially enjoyed model analysis because it encouraged them to read professional writing, and they enjoyed critiquing published papers. Some students felt that peer critique and revision were less valuable because they gave classmates an opportunity to copy their ideas and because they created extra work. Others, though, mentioned that they found peer critiquing in their biology course to be much more valuable than it had been in their freshman composition course because their evaluators were truly "peers" in that they shared knowledge about the subject matter and were engaged in solving common problems.

We consider our study to be exploratory in nature—an initial attempt to measure the effectiveness of techniques which have become firmly established in the composition classroom but which have not yet taken root in a significant way in the content classroom. Certainly more research is needed if we are to convince our colleagues in other disciplines that there are alternatives to the teacher-centered classroom. This preliminary study does suggest, however, that pedagogical techniques which encourage student

participation in the creation of knowledge produce better products than those which allow for passivity and isolation.